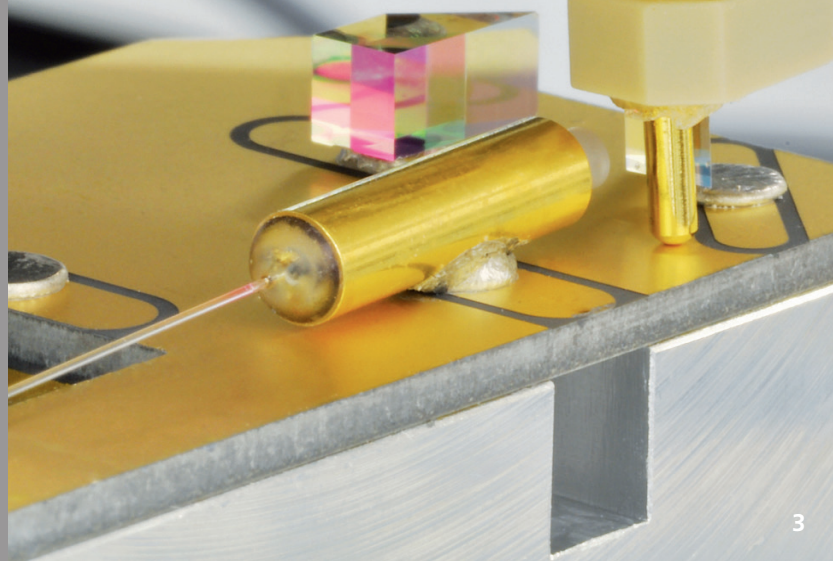


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## ASSEMBLY PROCESS FOR THE FREE-BEAM OPTICS OF A FREQUENCY COMB

### Task

For the space-based analysis of greenhouse gases in the atmosphere, LIDAR systems based on laser diagnostics can be employed to a great advantage. An important component of a LIDAR system is a frequency comb generator, which assumes the function of an absolute frequency reference. Thereby, the wavelength of the LIDAR beam source can be set or switched with long-term stability for selected positions in the spectrum of the trace gas to be examined. In addition to fiber-based assemblies, a frequency comb includes a free-beam optics, which has to be set up mechanically and thermally stable. Moreover, the dimensions of the components and the available installation space pose special challenges.

### Method

The free-beam optics consists of six components mounted on a ceramic plate with a surface area of  $26 \times 50 \text{ mm}^2$ . First, the piezo holder and then the retro mirror are mounted on this by means of reflow soldering. Afterwards, the ceramic plate is aligned on a water-cooled vacuum support. In the next step, the beam splitter cube is actively aligned and soldered on the beam axis defined by the retro mirror. In the last step, the free-space optics is adjusted to maximum output using the collimator adjustment and the collimator is fixed by soldering.

### Result

Thanks to the assembly method developed at the Fraunhofer ILT, free-space optics could be successfully constructed while the required tolerances were maintained (10 percent drop in performance after cooling). By increasing the mechanical stability of the ceramic plate, the institute can also improve the behavior of the assembly further.

### Applications

The range of applications of the assembly process described extends far beyond aerospace usage. This concept can be used for all laser beam sources with similar requirements, for example, in the field of medical technology or for labeling devices.

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2 Completed free-beam optic setup.

3 Partially assembled free-beam group.